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MONORAIL CONVEYORS used in eviscerating poultry

U. S. DEPARTMENT OF AGRICULTURE

AN INTERIM REPORT

U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
MARKETING RESEARCH DIVISION
AMS290

in cooperation with
the University of Georgia
College of Agriculture Experiment
Stations

CONTENTS

Introduction 3

Principal conveying systems. 4
Single conveyor with divided line--Type A. 4
Dual conveyors, 2 single lines--Type B 5
Single conveyor with twin shackles for a double line--Type C 6

Ownership and operating costs. 7

Comparison of systems. 8

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MONORAIL CONVEYORS USED IN EVISCERATING POULTRY
An Interim Report

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INTRODUCTION

This report sets forth some advantages and disadvantages of three principal methods of conveying poultry through the eviscerating area in large-volume poultry processing plants. It is based on studies made in plants where processing facilities are acceptable under the provisions of the Poultry Products Inspection Act. 1/ The comparisons developed are based on physical characteristics and ownership and operating costs of the equipment.

The Poultry Inspection Act, which requires post mortem inspection for all interstate shipments of ready-to-cook poultry, has confronted many processors with the problem of providing facilities suitable for adequate inspection. Significant in the modification that will be required in eviscerating equipment and layout in many plants is the monorail conveyor that moves defeathered poultry through the eviscerating area.

A study is now underway, of which this report is a part, of the overall evisceration operation including methods analysis, equipment, cost, layouts, and labor requirements. This report is being released at this early stage of the overall study without methods analysis, labor requirements, and crew size figures, primarily to provide information on operating principles, initial cost, adaptability to existing equipment, and capacity of the principal monorail conveyors. Plant operators will be able to use these data for plant modification or construction plans. Other interim reports will be released, as the study continues, on the analysis and evaluation of various related operations and equipment in the eviscerating operation.

The research upon which these studies are based is part of a broad program designed to reduce marketing costs and increase efficiency in the marketing of farm products.

1/ Public Law 85-172, August 28, 1957, provides for the compulsory inspection of poultry and poultry products.

PRINCIPAL CONVEYING SYSTEMS

Three conveying systems in general use in large poultry processing plants for moving defeathered poultry through the eviscerating area are: (1) The single conveyor, "split" or divided, routing alternate shackles to opposite sides of the eviscerating trough; (2) two single parallel conveyors are routed over the same eviscerating trough; and (3) a cross bar or bracket fastened to a single monorail conveyor with a bird suspended at each end of the bar. Most existing conveyors can be utilized in developing one of these conveying systems.

Single Conveyor with Divided Line - Type A

This system employs a single conveyor installed directly over the center of the eviscerating trough. Two lines are formed when alternate shackles are routed to opposite sides of the trough by a mechanical line divider shaped like an arrowhead and mounted directly under the conveyor track (fig. 1). As the divider rotates back and forth horizontally in an arc of about 40 degrees, the shackle chains or rods are alternately deflected to opposite sides of the eviscerating trough. Rods were considered more satisfactory for this purpose. The shackles are then held in position by horizontal

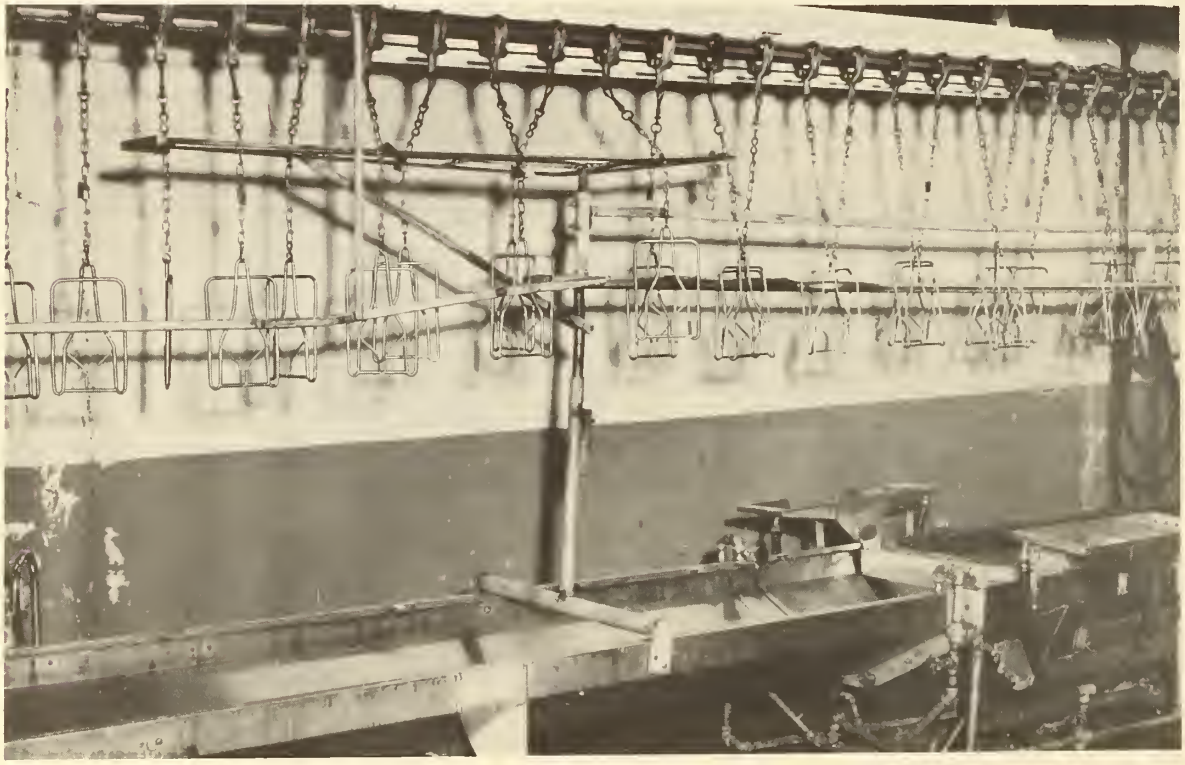

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Figure 1.--Single conveyor with divided line.

guide rails beyond the divider. The guide rails keep the lines separated and prevent the birds from turning, thus providing for more efficient operator performance.

Where conveyor trolleys of the single line are on 6-inch centers, the birds are spaced 12 inches apart on each side of the eviscerating trough when the line is divided. For a production rate of 40 birds per minute, a conveyor speed of 20 to 21 feet per minute is required.

Some advantages of this type of conveying system are: (1) Most standard commercial eviscerating lines can be converted to a divided line by installing the divider and guide rails. (2) Existing standard in-line processing equipment, such as the head remover and bird washer, may be utilized since the divided line can be permitted to change to single file at any point during the eviscerating operation. (3) There is a possibility that better crew balance can be attained by allowing the 2 lines to merge into single file at points where fractional labor requirements occur on each line. (4) Ownership and operating costs (excluding labor costs, not yet computed) are less than for the other 2 systems studied (table 1).

Some disadvantages are: (1) If it becomes necessary to slow down or stop the line because of conditions encountered on one side of the trough, operations on the opposite side of the trough also are affected. (2) Shifting and focusing of the eyes from one bird to the next causes objectionable worker eye fatigue. (3) The overall time taken to perform each operation increases because the operator is required to move his hands a greater distance. (4) When difficulty is encountered in performing an operation, a line speed of 20 feet per minute moves the bird beyond the normal work position at a pace too rapid for efficient completion of the operation. This usually causes interference with the adjoining operator as well as inferior workmanship on several subsequent birds.

Dual Conveyors, 2 Single Lines - Type B

This system involves routing 2 parallel single conveyors over one eviscerating trough (fig. 2). The shackles hang on 6-inch centers (as on the single conveyor with divided line). Since the lines are not divided, conveyor speed is reduced to half that of the single conveyor with divided line for the same volume of production and the birds continue to remain on 6-inch centers as they pass each operator.

Some advantages of this conveying system are: (1) Almost any standard commercial monorail conveyor can be used to convert to this system by routing a like conveyor parallel to it over one trough. (2) The slower line speed is considered advantageous because each operator employs minimum hand movement and shifting of eyes. Also, the bird stays within reach twice as long in case of difficulty encountered in performing a work cycle. (3) One conveyor can be slowed down or stopped without affecting the other. (4) Conveyor guide rails can be supported from above (fig. 3) rather than from the floor or flush trough.

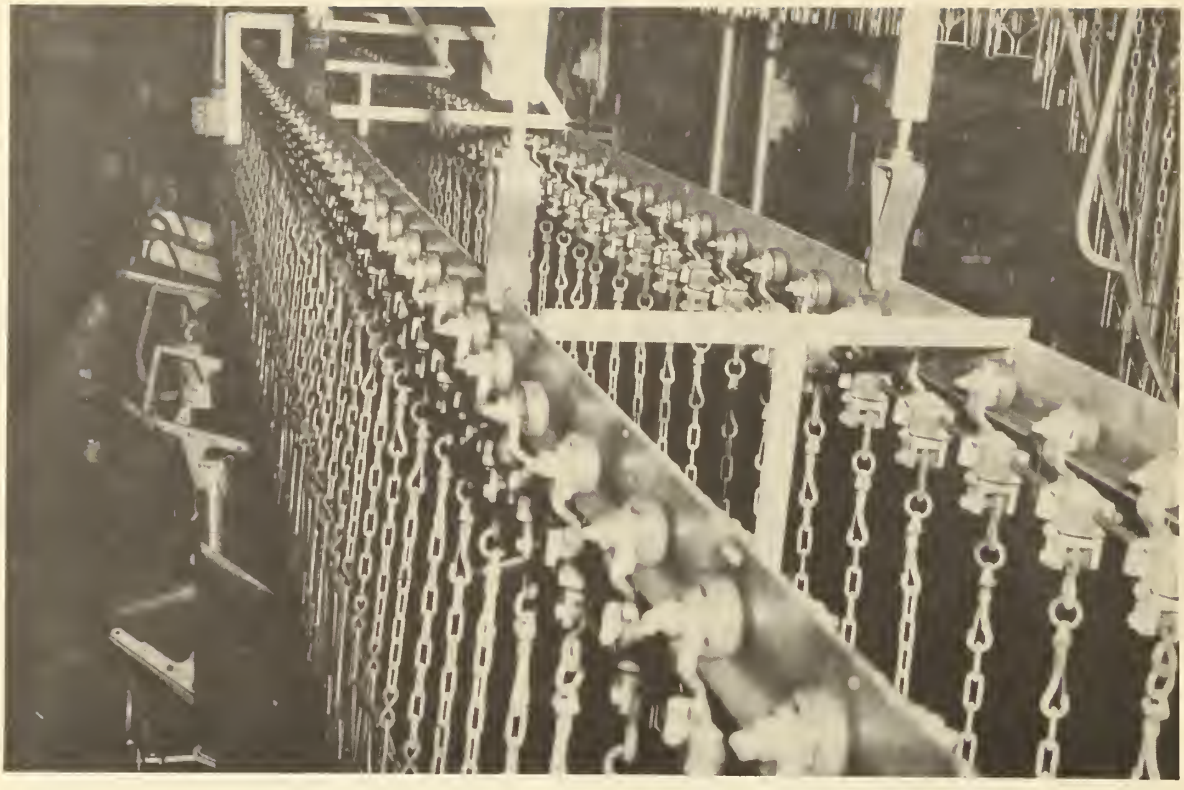

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Figure 2.--Dual conveyors, 2 single lines.

The disadvantages are: (1) Some standard in-line eviscerating equipment, such as the eviscerating trough, and the mechanical bird washer and head remover, will either have to be modified or replaced to accommodate 2 lines of birds. (2) The incidence of mechanical breakdown may be more frequent with the increase in amount of machinery required. (3) Total ownership and operating costs (excluding labor) are greater than for the single conveyor line system, because of additional conveyor footage and equipment modification (table 1).

Single Conveyor with Twin Shackles for a Double Line - Type C

This system employs a single conveyor and provides for the suspension of 2 shackles beneath each set of trolleys by means of a horizontal cross bar or bracket. The bars or brackets are attached to each set of trolleys at an angle so that shackles are not directly across from each other as they move along on opposite sides of the eviscerating trough (figs. 4 and 5). Thus, with trolleys spaced 6 inches apart, the system conveys the equivalent of 1 bird per 3 inches of conveyor track. Therefore, conveyor speed for a given production rate is only half that of Type A handling equal production.

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Figure 3.--Dual conveyors, 2 single lines, showing the guide rails supported from above.

This system is a combination of the 2 previously discussed conveyor systems. Consequently, most of the advantages and disadvantages are common to the other 2 systems. The main advantages are: (1) Birds pass each work station at a relatively slow rate, permitting adequate time to perform any unusual operation before the bird passes from the work area. (2) The dual-line effect is provided with a single conveyor; thus ownership and operating costs (excluding labor) are reduced accordingly (table 1). (3) Most eviscerating lines can be converted to this system by attaching the horizontal cross bars or brackets from which shackles can be suspended and by providing guide rails.

Some disadvantages are: (1) Stopping or slowing down one line directly affects the other. (2) Existing single-file in-line equipment must be modified or new equipment acquired to accommodate 2 lines of birds.

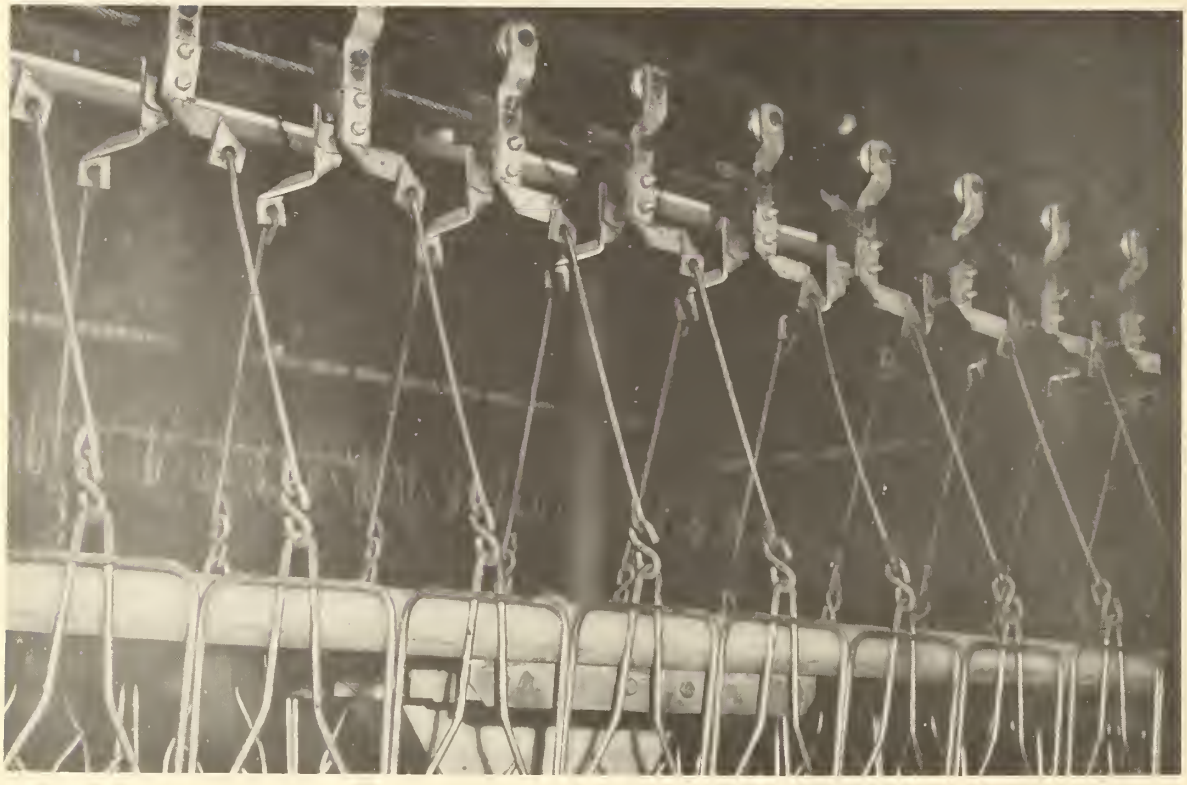

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Figure 4.--The single conveyor with twin shackles suspended from brackets.

OWNERSHIP AND OPERATING COSTS

In an attempt to compare the relative costs of owning and operating the 3 types of conveying systems, several manufacturers and distributors were contacted for prices of equipment. Prices quoted by these concerns varied considerably because of the many types of materials used for component parts of the systems. Therefore, an average price representing a composite of all types of materials was used in tables 1 and 2 to provide a fair comparison. The comparisons were based on an estimated minimum of 181 linear feet of conveyor for performing line loading, eviscerating, and line unloading operations (figs. 6, 7, and 8).

Cost figures other than those for owning and operating the conveying systems are not included in this report, and labor cost is excluded. It should also be noted that tables 1 and 2 compare costs of new installations only. Varying degrees of equipment depreciation and peculiarities of individual plants make it impossible to compare costs of modifying old equipment.

Table 2 lists the quantity and life expectancy of component parts for each conveying system and the initial costs, depreciation, and estimated installation costs that were used to compute total yearly ownership and operating costs, excluding labor (table 1).

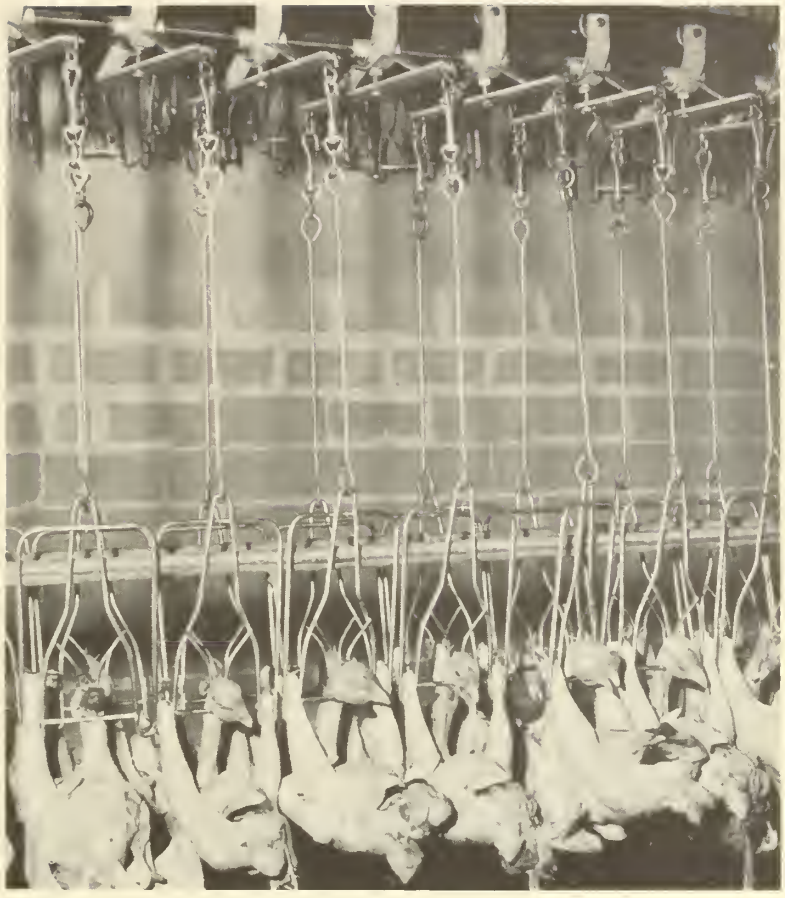

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Figure 5.--The single conveyor with twin shackles suspended from cross bars.

COMPARISON OF SYSTEMS

Conveyor types B and C with a slow line speed and close shackle spacing show an outstanding advantage over type A. The potential for increased production by increased line speed is much more limited for type A because it is required to run twice as fast as type B or C for the same rate of production.

There is no great monetary difference in the ownership and operating costs for the 3 conveying systems. The initial costs of the systems are $3,532 for type A, $6,386 for type B, and $4,905 for type C (table 1). The difference in annual ownership and operating costs between the type A and type C conveyors is only $314. The differences in cost between type B and type A is $898, and between B and C only $584.

Since the difference in annual ownership and operating costs between the different types operating at capacity amounts to less than $1,000 per year, it appears that the effectiveness of labor utilization and adaptability for specific facilities is a more important consideration than cost of equipment. Studies are now under way to determine which conveying system is best for the most effective utilization of labor.

SINGLE CONVEYOR WITH DIVIDED LINE
EVISCERATING CONVEYOR SYSTEM

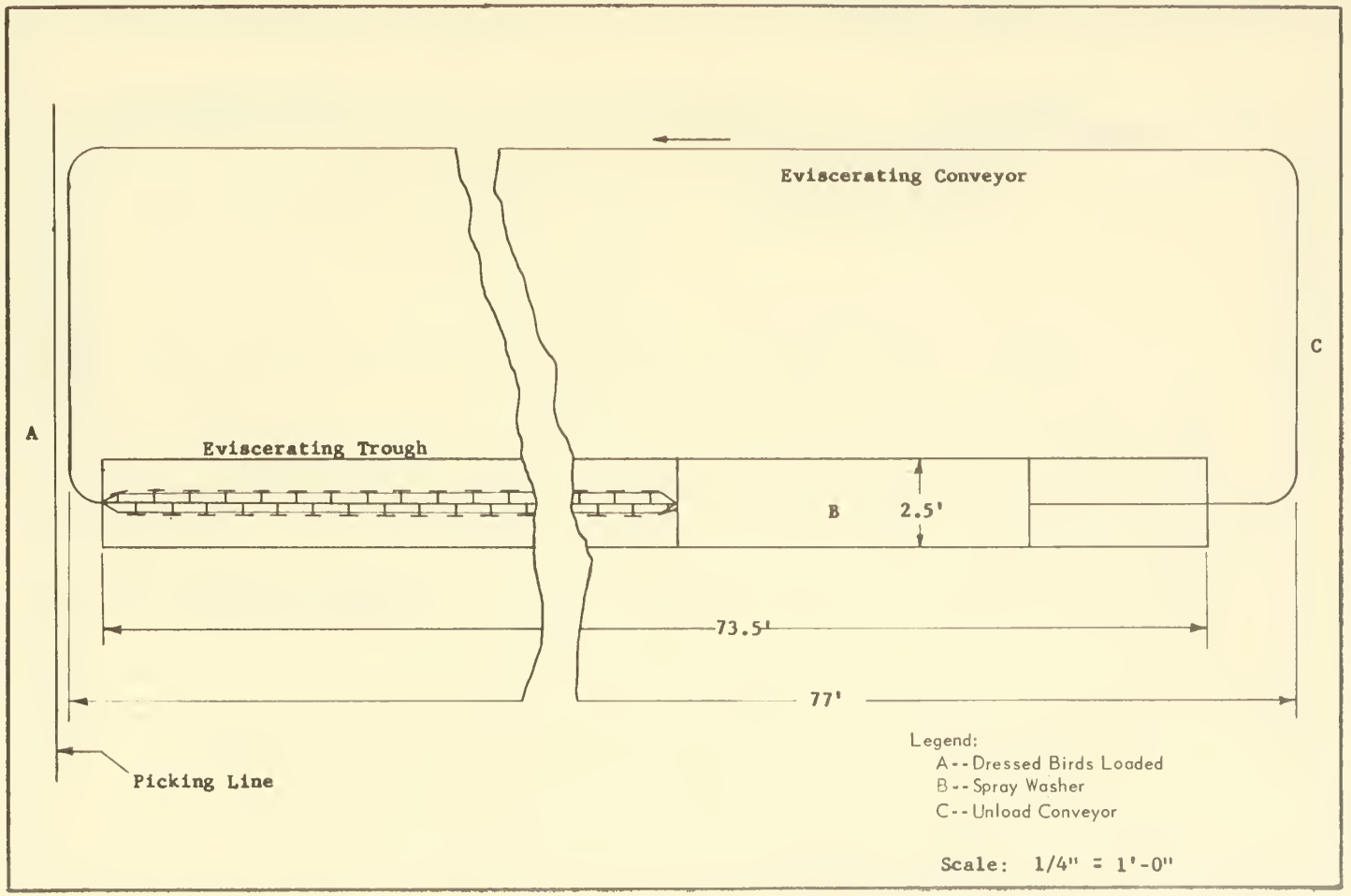

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Figure 6.

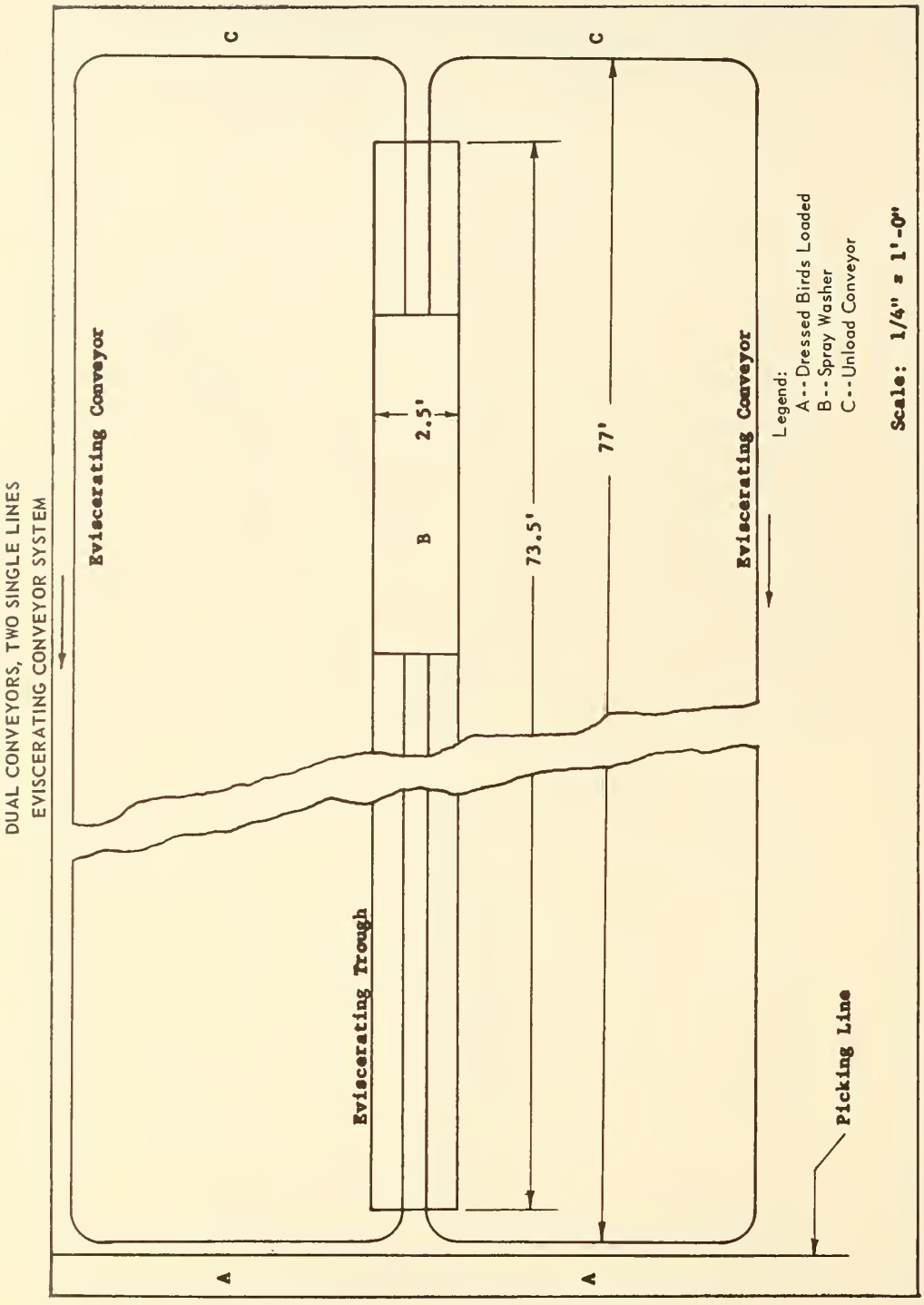
DUAL CONVEYORS, TWO SINGLE LINES
EVISCERATING CONVEYOR SYSTEM
Eviscerating Conveyor
C
C
B
2.5'
73.5'
77'
Eviscerating Conveyor
Eviscerating Trough
Picking Line
A
A
Legend:
A--Dressed Birds Loaded
B--Spray Washer
C--Unload Conveyor
Scale: 1/4" = 1'-0"
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Figure 7.

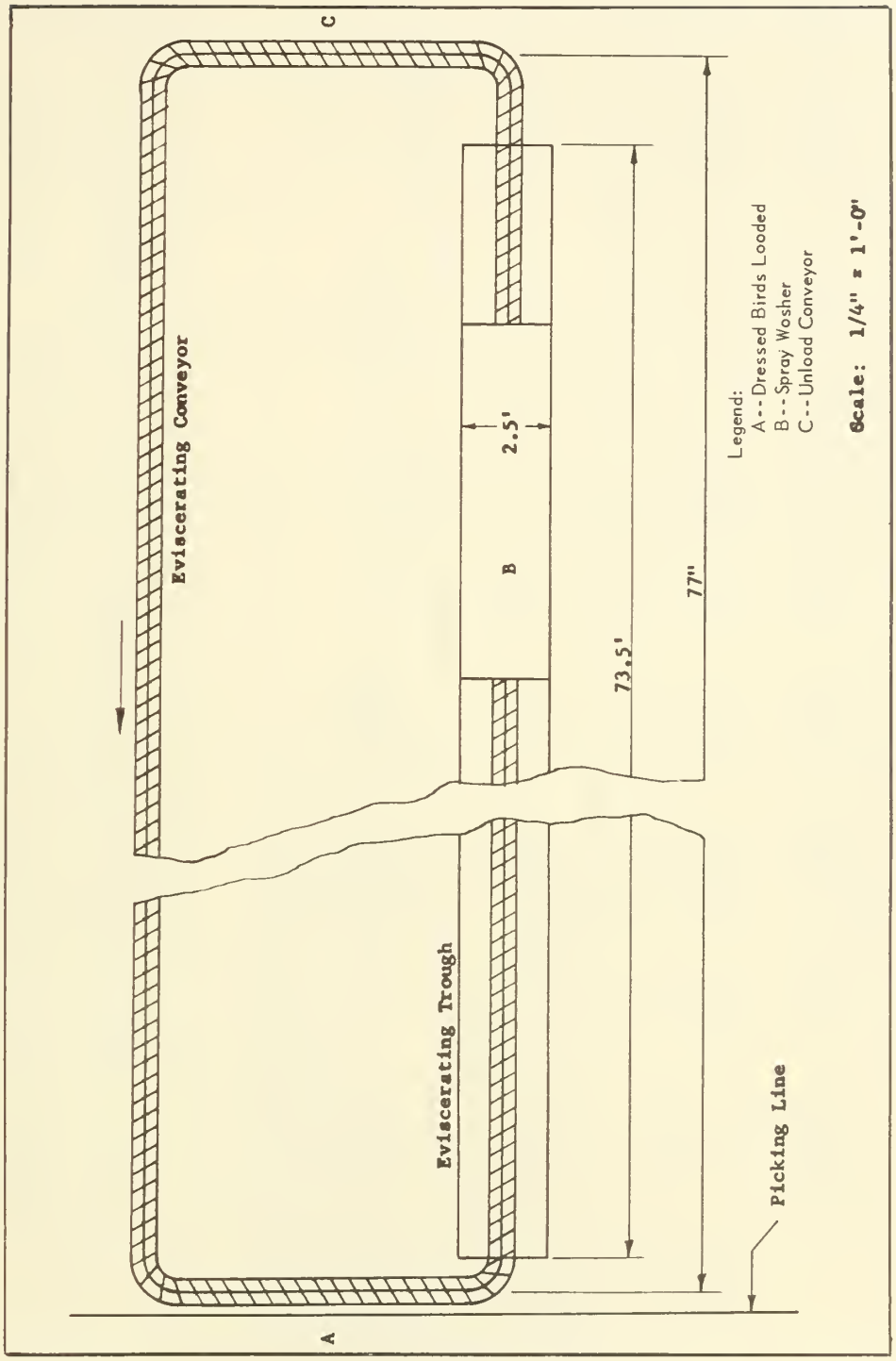
SINGLE CONVEYOR WITH TWIN SHACKLES FOR A DOUBLE LINE EVISCERATING CONVEYOR SYSTEM
C
Eviscerating Conveyor
B
2.5'
73.5'
77"
Legend:
A--Dressed Birds Looded
B--Spray Wosher
C--Unload Conveyor
Scale: 1/4" = 1'-0"
Eviscerating Trough
Picking Line
A
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Figure 8.

Table 1.--Comparative annual ownership and operating costs (excluding labor) for 3 types of eviscerating conveyors 1/

Type of conveyor 2/	Linear feet	Initial cost 3/	Ownership cost				Operating cost			Total annual cost
			Depreciation 3/	Interest 4/	Insurance taxes 4/	Total	Maintenance 5/	Electricity 6/	Total	
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
A	180	3,532.00	596.63	88.30	141.28	826.21	7/ 282.56	20.00	302.56	1,128.77
B	360	6,386.00	1,125.27	159.65	255.44	1,540.36	8/ 447.02	40.00	487.02	2,027.38
C	180	4,905.00	785.63	122.62	196.20	1,104.45	9/ 318.82	20.00	338.82	1,443.27

1/ Based on 2,000 hours of operation annually for 2 eviscerating lines over 1 flush trough at an average capacity of 2,400 birds per hour.

2/ A - single conveyor with divided line; B - dual conveyors, 2 single lines; C - single conveyor with twin shackles for double line.

3/ Figures taken from table 2.

4/ Interest at 5 percent of average investment. Insurance and taxes at 4 percent of initial investment.

5/ Maintenance costs are estimated since no reliable figures could be obtained.

6/ Electricity is based on a cost of $0.02 per KWH.

7/ Estimated to be 8 percent of initial cost.

8/ Estimated to be 7 percent of initial cost.

9/ Estimated to be 6.5 percent of initial cost.

Table 2.--Initial and depreciation costs of equipment required to construct 3 types of eviscerating conveyors 1/

Equipment	Unit	Expected life	Single conveyor, divided line			Single conveyor, double line			Dual conveyors, single lines		
			Units	Initial cost	Depreciation	Units	Initial cost	Depreciation	Units	Initial cost	Depreciation
		Years	Number	Dollars	Dollars	Number	Dollars	Dollars	Number	Dollars	Dollars
Cable	Feet	5	181	185.00	37.00	181	185.00	37.00	362	369.00	73.80
Cross bars or brackets	Each	10	0	-	-	362	778.00	77.80	0	-	-
Curves, vertical	Each	10	2	71.00	7.10	2	71.00	7.10	4	142.00	14.20
Curves, horizontal	Each	10	3	132.00	13.20	3	132.00	13.20	6	264.00	26.40
Drive unit	Each	10	1	588.00	58.80	1	588.00	58.80	2	1,175.00	117.50
Guide rail	Feet	10	110	636.00	63.60	110	636.00	63.60	110	636.00	63.60
Hanger rod, 3/8"	Feet	10	580	40.00	4.00	580	40.00	4.00	1,160	80.00	8.00
Lubrication unit	Each	10	1	86.00	8.60	1	86.00	8.60	2	172.00	17.20
Shackle and chain	Each	5	362	518.00	103.60	724	1,035.00	207.00	724	1,035.00	207.00
Take-up unit	Each	10	1	134.00	13.40	1	134.00	13.40	2	268.00	26.80
Track	Feet	10	165	200.00	20.00	165	200.00	20.00	330	400.00	40.00
Trollys	Each	3	362	742.00	247.33	362	742.00	247.33	724	1,484.00	494.67
Installation 2/		10		200.00	20.00		278.00	27.80		361.00	36.10
Total				3,532.00	596.63		4,905.00	785.63		6,386.00	1,125.27

1/ Cost is an average based on prices from various equipment manufacturers. The same quality material and equipment are used in all three systems.

2/ Installation cost is estimated to be 6 percent of the initial cost of the equipment.

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